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LAKE OSWEGO, OR 97035			2621	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/881,384	DESHPANDE, SACHIN G.	
	Examiner	Art Unit	
	Dennis Rosario-Vasquez	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06/28/2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-44 is/are pending in the application.
- 4a) Of the above claim(s) 38 and 39 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 12, 15, 19 and 20 is/are allowed.
- 6) ☒ Claim(s) 1-9, 11, 13, 14, 16-18, 21-37 and 40-44 is/are rejected.
- 7) ☒ Claim(s) 10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>6/24/04</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. The amendment was received on June 6, 2004 and has been entered. Claims 1-37 and 40-44 are pending.

Response to Arguments

2. Applicant's arguments with respect to claims 1-4, 6-11, 13, 14, 16-18, 21-28, 29-44 have been considered but are moot in view of the new ground(s) of rejection. Note that claim 5 is addressed in this action.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 2, 3, 4, 6, 7, 8, 9, 11, 13, 14, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 35, 36, 37, 40 and 41-44 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al. (US Patent 5,883,983 A).

Regarding claim 1, Lee et al discloses a filter system (fig. 1, numerals 200 and 90) for post-processing a digital image (fig. 1, num. 10: IMAGE STORE), said digital image having a plurality of visual-edge pixels and a plurality of visual non-edge pixels, said filter system comprising:

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(a) an edge mapper (fig. 1,num. 30:GLOBAL EDGE MAPPER) for producing a binary map (Fig. 3, label :BINARY EDGEMAP) of said visual edge pixels (Fig. 3, label: BINARY EDGE MAP has black squares as edge pixels.) and said visual non-edge pixels (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.);

(b) a pixel sorter comprising (Fig. 1,num. 60:FILTER DETERMINER);

(i) said pixel sorter (Fig. 1,num. 60:FILTER DETERMINER) for reading (Fig. 1,num. 60:FILTER DETERMINER receives the BINARY EDGEMAP via the output arrow of numeral 50:OR) said binary map (Fig. 3, label :BINARY EDGEMAP); and

(ii) said pixel sorter (Fig. 1,num. 60:FILTER DETERMINER) for assigning to each pixel a type of filtration (Fig. 1,num. 60:FILTER DETERMINER outputs edge and non-edge values to filters 70,80 and 90 in col. 4, lines 36-43.) to be provided by said filter system (Fig. 1, num. 70:AVERAGE FILTER, num. 80:WEIGHTED FILTER and num. 90:EDGE ENHANCEMENT FILTER);

(c) an adaptive filter (Fig. 1, num. 70:AVERAGE FILTER, num. 80: WEIGHTED FILTER and num. 90:EDGE ENHANCEMENT FILTER) for receiving output (via three arrows between numerals 60-90.) from said pixel sorter (Fig. 1,num. 60:FILTER DETERMINER); and

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- (d) said adaptive filter (Fig. 1, num. 70:AVERAGE FILTER, num. 80:WEIGHTED FILTER and num. 90:EDGE ENHANCEMENT FILTER) comprising:
- (i) a de-ringing module (Fig. 1,num. 70:AVEARGE FILTER and num. 80:WEIGHTED FILTER) for post-processing (Fig. 1,num. 70:AVEARGE FILTER processes an area which corresponds to white pixels with a binary "0" in col. 4, lines 31-40.) said visual non-edge pixels (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.); and
 - (ii) an edge sharpener (Fig. 1, num. 90:EDGE ENHANCEMENT FILTER sharpens edges by reducing staircase noise in col. 6, lines 19-21.) for post-processing (Lee et al. states, "...the edge enhancement filter 90 uses the binary edge map information...(col. 6, lines 14,15).") said edge pixels (Fig. 3, label: BINARY EDGE MAP has black squares as edge pixels.).

Regarding claim 2, Lee et al. discloses the filter system of claim 1, said edge mapper further comprising:

- (a) an edge detector (Fig. 1, num. 20:GRADIENT IMAGE GENERATOR in col. 2, lines 48-55) comprising:
 - (i) said edge detector (Fig. 1, num. 20:GRADIENT IMAGE GENERATOR) for calculating intensity gradients (" ∇_h " and " ∇_v " are gradients in col. 2, lines 66,67) for each pixel in said digital image (Fig. 1, label: IMAGE DATA);

(ii) said edge detector (Fig. 1, num. 20:GRADIENT IMAGE GENERATOR) for assigning a first edge value ("1" for an edge in equation 1 of column 2.) to each edge pixel based (Formula 1 uses gradient " ∇_h " and " ∇_v " to generate a "1") on said intensity gradients (" ∇_h " and " ∇_v " are gradients); and

iii) said edge detector (Fig. 1, num. 20:GRADIENT IMAGE GENERATOR) for assigning a second edge value ("0" for an edge in equation 1 of column 2.) to each non-edge pixel (A "0" value represent a non-edge or white square in the image of figure 3: BINARY EDGE MAP.) based on said intensity gradients (Formula 1 uses gradient " ∇_h " and " ∇_v " to generate a "0"); and

(b) a memory storage array (Fig. 1, num. 60: FILTER DETERMINER "stores the binary edge map information...(col. 4, lines 23,24).") for storing said first edge ("1") value for each edge pixel and for storing said second edge value ("0") for each non-edge pixel.

Claims 3 and 4 are standard edge detection methods; therefore, official notice is implemented.

Regarding claim 6, Lee et al discloses the filter system of claim 2, said pixel sorter (fig. 1,num. 60:FILTER DETERMINER) further comprising:

(a) a first comparator (A classification is performed between pixels in col. 4, lines 24-45.) for sorting said visual edge pixels (Fig. 3, label: BINARY EDGE MAP has black squares as edge pixels.) from said visual non-edge pixels (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.);

(b) a selector ("filter window" in col. 4, line 27.) comprising:

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- (i) said selector ("filter window" in col. 4, line 27.) receiving output (via arrow between numerals 50 and 60 of figure 1) from said first comparator (fig. 1, num. 50:OR "performs a logical OR operation" in col. 4, lines 16,17.); and
- (ii) said selector ("filter window" in col. 4, line 27.) designating a kernel of pixels (The filter window is "of a selected size" in col. 4, line 27.) near each pixel being processed (The filter window uses all of the pixels in the window in col. 4, line 31-35.); and
- (c) a second comparator (A comparison is performed in col. 5, lines 15,16.) comprising:
 - (i) said second comparator (A comparison is performed in col. 5, lines 15,16.) receiving output from said selector ("filter window" in col. 4, line 27.); and
 - (ii) said second comparator (A comparison is performed in col. 5, lines 15,16.) assigning types of filtration (Filtration on no filtration are performed based on the comparison as mentioned in col. 5, lines 15-21.) to each pixel being processed (in the "filter window" in col. 5, line 15 and shown in fig. 2A.) based (The filter window contains pixels of a binary edge map generated from the equation 1 in col. 2 and equations 2,3 and 4 in column 3.) at least in part on a sum of first edge values (Column 2, equation 1 has a sum of edge gradients in col. 2, lines 61-67.) and second edge values (Column 3, equations 2,3 and 4 has another sum of edge values.) of said pixels (The filter window uses all of the pixels in the window in col. 4, line 31-35.) in said kernel of pixels (The filter window is "of a selected size" in col. 4, line 27.).

Regarding claim 7, Lee et al. discloses the filter system of claim 6, wherein said kernel of pixels (The filter window is "of a selected size" in col. 4, line 27.) is a grid of pixels ("3 X 3" in col. 4, lines 48-50.) in which said pixel being processed is a center pixel in said grid of pixels (The filter window uses all of the pixels in the window in col. 4, line 31-35.).

Regarding claim 8, Lee et al. discloses the filter system of claim 6, wherein said second comparator (A comparison is performed in col. 5, lines 15,16.) is for applying de-ringing filtration by said de-ringing module (Fig. 1,num. 80:WEIGHTED FILTER) to said pixel being processed if said pixel being processed (The filter window uses all of the pixels in the window in col. 4, line 31-35.) is a visual non-edge pixel (If all values in the filter window are "0", then the region in the filter window is a homogeneous or non-edge area.) and said sum of first edge values (Column 2, equation 1 has a sum of edge gradients in col. 2, lines 61-67.) and second edge values (Column 3, equations 2,3 and 4 has another sum of edge values.) of said pixels (The filter window uses all of the pixels in the window in col. 4, line 31-35.) in said kernel of pixels (The filter window is "of a selected size" in col. 4, line 27.) is less than a predetermined threshold value (" T_g " in col. 3, lines 8-11.) defining a true visual edge (" T_g " is used for determining an edge as shown by equation 1 in column 2.)

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Regarding claim 9, Lee et al. discloses the filter system of claim 6, wherein said first comparator (A classification is performed between pixels in col. 4, lines 24-45.) is for applying edge sharpening filtration by said edge sharpener (Fig. 1, num. 90: EDGE ENHANCEMENT FILTER) to said pixel being processed (The filter window uses all of the pixels in the window in col. 4, line 31-35.) if said pixel being processed (All pixels in the filter window.) is a visual edge pixel (Fig. 1, num. 90:EDGE ENHANCEMENT FILTER uses the binary edge map in col. 6, lines 14-16 which contains edge pixels as shown by the black squares of the binary edge map of figure 3.)

Regarding claim 11, Lee et al. discloses the filter system of claim 6, said filter system further comprising:

- a) a grayscale ("Sobel gradient operator" generates a gradient image in col. 2, lines 49-53.);
- b) said grayscale ("Sobel gradient operator" generates a gradient image in col. 2, lines 49-53.) for summing grayscale values (The Sobel gradient operator generates grayscale or gradient values " ∇_h " and " ∇_v " which are summed in equation 1 of column 2.) of all visual edge pixels (The gradient or grayscale values " ∇_h " and " ∇_v " that are summed represent the "whole image" in col. 2, lines 56,57.) in said kernel of pixels (The filter window is "of a selected size" in col. 4, line 27. Thus, the filter window size can be selected as the size of the whole image.); and
- c) said grayscale ("Sobel gradient operator" generates a gradient image in col. 2, lines 49-53.) summing grayscale values (Grayscale or gradient values " ∇_h " and " ∇_v " which are summed in equation 1 of column 2 represent visual non-edge pixels

as "0" and edge pixels as "1" which are determined using a threshold T_g shown in equation 1 of column 2.) of all visual non-edge pixels in said kernel of pixels (The filter window is "of a selected size" in col. 4, line 27. Thus, the filter window size can be selected as the size of the whole image.).

Regarding claim 13, Lee et al. discloses the filter system of claim 1, said de-ringing module (Fig. 1, num. 70: AVERAGE FILTER and num. 80: WEIGHTED FILTER) further comprising a weighting module (Fig. 1, num. 70: AVERAGE FILTER uses weights in col. 4, lines 61, 62.);

said weighting module (weights in col. 4, lines 61, 62) altering a grayscale value (Fig. 10: IMAGE STORE contains "decompressed grey levels" in col. 2, line 52 and col. 3, line 5.) of each visual non-edge pixel (The weights operate on non-edges or "homogeneous area" using the comparison in col. 4, lines 36-39.) for final display in direct proportion (A final image is "displayed" in col. 5, line 64 that uses the results of an averaging filter to "replace" grey values in memory 10 in col. 5, lines 61-65.) to an average grayscale value (The weighted average filter 70 of figure 1 averages pixels within a 3 X 3 kernel in col. 5, lines 36, 37.) of all visual non-edge pixels ("homogeneous area" in col. 4, lines 36-39.) in a kernel of pixels ("3 X 3" kernel in col. 5, line 36).

Regarding claim 14, Lee et al. performs an averaging with a filter using only non-edge pixels in col. 4, lines 36-39.

Regarding claim 21, Lee et al. discloses the filter system of claim 1, said edge sharpener (Fig. 1, num. 90:EDGE ENHANCEMENT FILTER) further comprising a limiter (Fig. 1, num. 90:EDGE ENHANCEMENT FILTER operates when both filters 70 and 80 of figure 1 are applied in col. 6, lines 9-11. Thus if one of the filters of 70 or 80 are used, then the filter 90:EDGE ENHANCEMENT FILTER will not be applied.) for decreasing said edge sharpening (Fig. 1, num. 90:EDGE ENHANCEMENT FILTER) to avoid saturation of visual edges.

Claim 22 (original): The filter system of claim 1, said filter system (fig. 1,numerals 200 and 90) sharing data and calculations (Fig. 1, num. 30 generates data which is stored in fig. 1,num. 60 in col. 4, lines 23,24 and accessed by numerals 200 and 90 via respective arrows as shown in figure 1.) between said edge mapper (fig. 1,num. 30:GLOBAL EDGE MAPPER), said pixel sorter (Fig. 1,num. 60:FILTER DETERMINER), and said adaptive filter (Fig. 1, num. 70:AVERAGE FILTER, num. 80:WEIGHTED FILTER and num. 90:EDGE ENHANCEMENT FILTER) to reduce calculations.

Claim 23 has been addressed in claim 1 except for the limitation of:

(e) displaying ("displayed by using adapted image data...col. 5, line 64. Note that adapted image data corresponds to the outputs of filters 70-90 of figure 1.) said edge pixels (Fig. 3, label: BINARY EDGE MAP has black squares as edge pixels.) after edge sharpening ("reducing blocking effects" in col. 6, lines 26-28. Note that blocking effects correspond to an edge or staircase noise in col. 1, lines 20-22.) and said non-edge pixels (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.) after de-ringing (Fig. 1, numerals 70 and 80 reduce ringing in col. 5, lines 57-65).

Claim 24 has been addressed in claim 11.

Regarding claim 25, Lee et al. discloses the method of claim 23, said step of sorting pixels (Fig. 1, num. 60: FILTER DETERMINER) of said edge map (Fig. 3, label: BINARY EDGEMAP) further comprising the step of sorting each non-edge pixel (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.) according to a number of edge pixels ("all" edge values in col. 4, lines 31-35) in a kernel of pixels ("filter window" in col. 4, line 32) surrounding (A kernel contains a non-edge pixel or white square surrounded by an edge pixel or black square as shown in figure 3: BINARY EDGE MAP.) said non-edge pixel (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.).

Regarding claim 26, Lee et al. discloses the method of claim 23, said step of sorting pixels (Fig. 1,num. 60:FILTER DETERMINER) of said edge map (Fig. 3, label: BINARY EDGEMAP) further comprising the step of sorting a non-edge pixel (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.) for no filtering ("filter 80 does not perform a filtering operation for the central point (col. 5, lines 16,17)..." [if the central point is an edge or black square generated from the binary edge map of figure 3.) if a number of edge pixels ("any" edge value in col. 4, line 36) in [said] a kernel of pixels ("filter window" in col. 4, line 32) surrounding (A kernel contains a non-edge pixel or white square surrounded by an edge pixel or black square as shown in figure 3: BINARY EDGE MAP.) said non-edge pixel (Fig. 3, label: BINARY EDGEMAP has white squares as non-edge pixels.) is greater than a selected threshold (If a single edge is found in the kernel then the region of the kernel contains an edge region in col. 4, lines 35,36.).

Clam 27 was addressed in claim 13.

Regarding claim 28, de-ringing occurs in fig. 1, numerals 70,80 which receive data from sorter 60 and mapper 30.

Regarding claim 30, sharpening occurs in fig. 1, num. 90 which receives data from sorter 60 and mapper 30.

Regarding claim 31, Lee et al. discloses all the limitations in claim 1, except for:

(d) wherein said steps of edge sharpening (Fig. 1, num. 90:EDGE ENHANCEMENT FILTER which reduces blocking effects of an edge in col. 6, lines 26-29.) and de-ringing (Fig. 1,num. 70:AVEARGE FILTER and num. 80:WEIGHTED FILTER reduces ringing and blocking effects.) may be performed substantially simultaneously (Lee et al. states,"...the present invention effectively reduces the blocking effects and the ringing noise...without any increases in bit rate (col. 7, lines 29-32)." Thus, the "additional step of using an enhancement filter 90" in col. 6, lines 26,27 of figure 1 does not increase the bit-rate, suggesting a decrease or the same bit-rate. A decrease or the same bit-rate suggests a parallel or simultaneous operation.)

Claim 32 (original): The method of claim 31, said step of sorting further comprising the steps of:

(a) designating (Fig.1,num. 60:FILTER DETERMINER classifies regions using a filter window of pixels in col. 4, lines 26-31 and shown in figure 3 where a 5 X 5 WEIGHT FILTER window is used on the BINARY EDGE MAP.) a group of pixels (5 X 5 WEIGHT FILTER window) surrounding and including each non-edge pixel (white square in the BINARY EDGE MAP of figure 3) being sorted (The window contains edge, black squares, and non-edge pixels, white squares, that surround each other as shown by figure 3, label: BINARY EDGE MAP.);

(b) reading a grayscale value (Fig. 1,num. 46: FILTER DETERMINER reads gradient data from fig. 1,num. 50:OR which outputs an image shown in figure 3, label :BINARY EDGEMAP) of each pixel(Fig. 2A shows how each pixel in a 5 X 5 filter window is read.) in said group of pixels (5 X 5 WEIGHT FILTER window);

(c) omitting (Lee et al. states, "...the weighted filter 80 does not perform a filtering operation...(col. 5, lines 16,17)."; and Lee et al. states," If the adaptively filtered signal produced by the...weighted filter 80 is applied, the edge enhancement filter 90 [is applied](col. 6, lines 9-14.)." Thus, if the ringing filter 80 does not perform a filtering operation, the edge enhancement filter 90 or sharpener is not applied.) said de-ringing (Fig. 1,num. 70:AVEARGE FILTER and num. 80:WEIGHTED FILTER reduces ringing and blocking effects.) and said edge sharpening (Fig. 1, num. 90:EDGE ENHANCEMENT FILTER which reduces blocking effects of an edge in col. 6, lines 26-29.) for said non-edge pixel (white square in the BINARY EDGE MAP of figure 3) if said group of pixels (5 X 5 WEIGHT FILTER window) includes at least a selected minimum number (1 central pixel) of edge pixels (Lee et al. states, "If the central point "11" of the filter window shown in FIG. 2A is an edge point, the weighted filter 80 does not perform a filtering operation for the central point (col. 5, lines 16,17)."); and

(d) de-ringing (Fig. 1, num. 70:AVERAGE FILTER reduces ringing and blocking effects in col. 5, lines 57-65 if all pixel values in the filter window are "0" in col. 4, lines 35-39.) said non-edge pixel (white square or "0" in the BINARY EDGE MAP of figure 3) if said group of pixels (5 X 5 WEIGHT FILTER window) does not include at least a selected minimum number (No edge pixels or "1" have to be present in the group

of pixels to apply the AVERAGE FILTER in col. 4, lines 31-35.) of edge pixels ("1" corresponds to edge pixels).

Claim 33 was addressed in claim 13.

Claims 35 and 37 were addressed in claim 1.

Claim 36 was addressed in claim 2.

Claim 40 was addressed in claim 26.

Claims 41-44 were addressed in claim 31.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 16, 17, 18, 29 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US Patent 5,883,983 A) in view of Muka et al. (US Patent 5,774,599 A).

Regarding claim 16, Lee et al. does not teach the limitations of claim 16, but does suggest using multiple filtering methods that sharpen images. Using figure 1, filters 70 is an averaging method, 80 is a weighting method and 90 is a directional method that sharpens images by reducing blocking effects which is stair case noise along an edge of an image in col. 1, lines 20-22, col. 5, lines 57-65 and col. 6, lines 24-29.

However, Muka et al., in the field of endeavor of image enhancement, teaches the limitations of claim 16 of an edge sharpener further comprising an unsharp masking method ("unsharp mask (USM) filter algorithm" at Muka et al., col. 7, lines 14,15), said unsharp masking method adding a high pass filtered image of the digital image to the digital image. Column 7 has a derivation of unsharp masking that includes adding a highpass image to the original image (first equation of the series of equations for the derivation can be algebraically manipulated).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify Lee's method of sharpening edges using a sum of weights with the teachings of Muka et al.'s USM filter algorithm, because Muka et al. teaches a "computationally efficient way of separating [an] image into frequency components (Muka et al., col. 7, lines 13,14)" that provides a "sharpness enhanced version of the image (Muka et al., col. 7, line 24,25)".

Regarding claim 17, Muka et al. teaches an unsharp masking module sharpening visual edges in said digital image by an edge sharpening factor k (The series of equations of column 7 uses a "boost" factor for an output image).

Regarding claim 18, Muka et al. teaches a high pass filtered image being obtained by subtracting a low pass filtered image of said digital image from a scaled version of said digital image (The last equation of the series of equations in the derivation of column 7 has an lowpass image with a boost factor subtracted from original image with a highboost factor.)

Claims 29 and 34 were addressed in claim 16.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US Patent 5,883,983 A) in view of Braica (US Patent Application Publication 2002/0097439 A1).

Regarding claim 5, Lee et al. discloses the filter system of claim 2, said edge detector (Fig. 1, num. 20: GRADIENT IMAGE GENERATOR in col. 2, lines 48-55) for executing an edge value subroutine (Fig. 1, num. 40: local edge mapper uses a sequence of steps that uses "if" statements in col. 4, line 1 and 4 that corresponds to a subroutine.) for calculating said first edge value ("1" for an edge in equation 1 of column 2.) for each visual edge pixel and said second edge value ("0" for an edge in equation 1 of column 2.) for each visual non-edge pixel, said edge value subroutine further comprising:

(a) at least one edge detection operator ("Sobel gradient operator" in col. 3, lines 1,2.) for calculating intensity gradients for each pixel in said digital image (fig. 1, num. 10: IMAGE STORE);

(b) an i variable ("i, j" from col. 2, line 66 to col. 3, line 2 correspond to horizontal and vertical coordinates, respectively.) for storing a horizontal coordinate of each pixel in said digital image (fig. 1, num. 10: IMAGE STORE);

(c) a j variable ("i, j" from col. 2, line 66 to col. 3, line 2 correspond to horizontal and vertical coordinates, respectively.) for storing a vertical coordinate of each pixel in said digital image (fig. 1, num. 10: IMAGE STORE);

(d) $g_{H1}(i, j)$ and $g_{H2}(i, j)$ variables (" ∇_h " and " ∇_v " are horizontal and vertical gradients, respectively in col. 2, lines 66,67.) for storing intensity gradients calculated by said at least one edge detection operator ("Sobel gradient operator" from col. 2, line 66 to col. 3, line 2.);

(e) an Edge-strength(i, j) variable (" σ_n " in col. 3, lines 46,47) for storing an average (Gradient values, $g(i, j)$, divided by N is an average shown in equation 3 of column 3.) of said intensity gradients (" ∇_h " and " ∇_v " are gradient values, $g(i, j)$, supplied from fig. 1, num. 20 to fig. 1, num. 40 in col. 3, lines 13,14) for each pixel in said digital image (fig. 1, num. 10: IMAGE STORE);

(f) an Edge-Threshold variable (" T_n " in equation 2 of column 3 and in col. 3, line 31.) for storing a selectable (A threshold T_g can be selected to a value of 100 when there are 256 grey levels, thus T_g can be selected to another value when the number of grey levels change.) threshold value (" T_g " in equation 2 of column 3 and in col. 3, lines 4,5.) for defining a true visual edge (" T_n " uses a "1" to define an edge in col. 4, lines 1-5.) containing said visual edge pixels (Fig. 3, label: BINARY EDGE MAP has black squares as edge pixels. Note that the "1" above identifies the black squares of figure 3 as edge pixels.); and

(g) an Edge-value(i, j) variable ("edge(i, j)" in equation 1 of column 2.) for storing said first edge value ("1" of equation 1 in column 2.) for each visual edge pixel and said second edge value ("0" of equation 1 in column 2.) for each visual non-edge pixel;

Lee et al. does not teach the remaining limitation "(h)", but does suggest multiple methods of comparing a gradient value to obtain binary values in col. 3, lines 6-11 and col. 4, lines 1-7. Thus, Lee et al.'s suggests that data can be thresholded by more than one method.

However, Braica, in the field of endeavor of edge detection, does teach the remaining limitation of:

(h) wherein an edge value subroutine (Fig. 6) is defined as:

Edge-strength(i, j) = ($lg_{H1}(i, j)$ + $lg_{H2}(i, j)$)/2 (Fig. 6,num. 101:Calculate average intensity value of left context is computed to obtain a magnitude of averages 104.);

if (Edge-strength(i, j) > Edge-Threshold) (Fig. 6,num. 101:Calculate average intensity value of left context > "Threshold" in decision box labeled "Magnitude > Threshold?")

(

Edge-value (i, j) = 1 (Fig. 6,num. 107:Assign gain value assigns a gain to the magnitude if the magnitude is greater than the threshold.),

)

else

(

Edge-value(i, j) = 0 (Fig. 6,num. 106: "gain=0" for the magnitude if the magnitude is less than the threshold.),

)

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify Lee et al.'s two methods of comparing a gradient values with another method taught by Briaca, because Briaca's method of thresholding "compensates for expected distortion of the image at ...[the]...edge...(col. 3 paragraph [0042])."

Allowable Subject Matter

8. Claims 12,15,19 and 20 allowed.
9. Claim 10 is objected to as being dependent upon a rejected base claim 1, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
10. The following is a statement of reasons for the indication of allowable subject matter:

Claim 10 is allowable over the prior art for requiring a second comparator that determines no sharpening and de-ringing filtering based on a non-edge pixel.

The closest prior art is Lee et al. (US Patent 6,665,346 B1) that perform no de-ringing filtering and no sharpening or de-blocking based on block differences in col. 3, lines 46-62 and col. 5, lines 26-31.

Claims 12,15,19 and 20 are allowable over the prior art for the step of a subroutine with each function described.

The prior art does not teach the subroutines of claims 12,15,19 and 20.

The benefit of claims 10,12,15,19 and 20 ensures that the actual edges are not blurred and no true details are lost.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Lee et al. (US Patent 6,665,346 B1) is pertinent as teaching a method of performing no filtering based on a difference between image blocks in col. 3, lines 45-62.

Daly et al. (US Patent 6,044,182 A) is pertinent as teaching a method of averaging 116 and 122 a gradient 114 and 120 to generate 142 and 144 a binary image 146 using the method of figure 13.


Hrytzak et al. (US Patent 5,327,257 A) is pertinent as teaching a method of sharpening an image and reducing ringing using figure 1, label: Derive Resultant Output Interpolation Result P.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dennis Rosario-Vasquez whose telephone number is 703-305-5431. The examiner can normally be reached on 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Boudreau can be reached on 703-305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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